# TEST RIDER

*Comprehensive Simulator Test Series for JEE Main & Advanced*

# JEE MAIN

## (PAPER ONE PREP UP)

**HALF TEST 1**
**(XI SYLLABUS) FULLY SOLVED**

*Mock Questions from Class XIth Syllabus with Complete Solutions*

## INSTRUCTIONS

- This test consists of 30 questions and each question is allotted 4 marks for correct response.
- Candidates will be awarded marks as stated above for correct response of each question. 1/4 marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
- There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted according as per instructions.

**1.** For the reaction, $A(g) + B(g) \longrightarrow C(g) + D(g)$, $\Delta H°$ and $\Delta S°$ are respectively, $-29.8$ kJ mol$^{-1}$ and $-0.100$ kJ K$^{-1}$ mol$^{-1}$ at 298 K. The equilibrium constant for the reaction at 298K is

(a) 1 (b) 10 (c) $1.0 \times 10^{-10}$ (d) $1.0 \times 10^{10}$

**2.** The group of molecules having identical shape is

(a) $PCl_5$, $IF_5$, $XeO_2F_2$ (b) $BF_3$, $PCl_3$, $XeO_3$
(c) $ClF_3$, $XeOF_2$, $XeF_3^+$ (d) $SF_4$, $XeF_4$, $CCl_4$

**3.** Which of the following pairs of compounds are positional isomers?

(a) $CH_3—CH_2—CH_2—\underset{\underset{O}{\|}}{C}—CH_3$ and $CH_3—CH_2—\underset{\underset{O}{\|}}{C}—CH_2—CH_3$

(b) $CH_3—CH_2—CH_2—CH_2—CHO$ and $CH_3—CH_2—CH_2—\underset{\underset{O}{\|}}{C}—CH_3$

(c) $CH_3—CH_2—CH_2—\underset{\underset{O}{\|}}{C}—CH_3$ and $CH_3—\underset{\underset{CH_3}{|}}{CH}—CH_2—CHO$

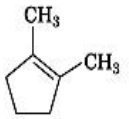
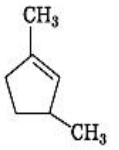
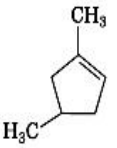
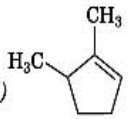
(d) $CH_3—CH_2—\underset{\underset{O}{\|}}{C}—CH_2—CH_3$ and $\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>\!CH—CH_2—CHO$

**4.** $A + 2B + 3C \rightleftharpoons AB_2C_3$

Reaction of 6.0g of $A$, $6.0 \times 10^{23}$ atoms of $B$ and 0.036 mole of $C$ yields 4.8 g of compound $AB_2C_3$. If the atomic masses of $A$ and $C$ are 60 and 80 u, respectively, the atomic mass of $B$ is (Avogadro's number = $6 \times 10^{23}$).

(a) 50 u (b) 60 u
(c) 70 u (d) 40 u

**5.** Which compound would give 5-keto-2-methyl hexanal upon ozonolysis?

(a) 
(b) 
(c) 
(d) 

**6.** A dilute aqueous solution of $Na_2SO_4$ is electrolysed using platinum electrodes. The products at the anode and cathode respectively are

(a) $O_2$ and $H_2$ (b) $S_2O_8^{2-}$ and Na
(c) $O_2$ and Na (d) $S_2O_8^{2-}$ and $H_2$

**7.** Identify a reagent from the following list which can easily distinguish between 1-butyne and 2-butyne

(a) bromine, $CCl_4$ (b) $H_2$, Lindlar catalyst
(c) dil. $H_2SO_4$ (d) ammonical $CuCl_2$ solution

**8.** An aqueous solution of 6.3 g oxalic acid dihydrate is made upto 250 mL. The volume of 0.1N NaOH required to completely neutralise 10 mL of this solution is

(a) 40 mL (b) 20 mL
(c) 10 mL (d) 4 mL

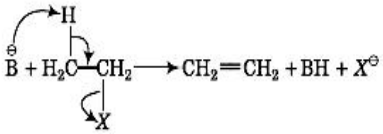
**9.** The best indicator for detection of end point in titration of a weak acid and a strong base is

(a) methyl orange (3 to 4)
(b) methyl red (5 to 6)
(c) bromothymol blue (6 to 7.5)
(d) phenolphthalein (8 to 9.6)

**10.** The species that does not contain peroxide ion is

(a) $PbO_2$ (b) $H_2O_2$
(c) $SrO_2$ (d) $BaO_2$

**11.** β-elimination reaction is carried out with base ($\bar{B}$) as shown below?



The following bases are used for above reaction.

I. $RO^-$ II. $NO_3^-$
III. $RCOO^-$ IV. $CN^-$
V. $\bar{O}H$

The decreasing order of reactivity for the above elimination is

(a) I > V > IV > III > II
(b) IV > V > II > I > III
(c) V > I > II > III > IV
(d) III > I > IV > V > II

**12.** The geometries of $XeF_4$, $XeO_4$ and $XeO_2F_2$ respectively are

(a) tetrahedral, square pyramidal and square planar
(b) square pyramidal, square planar and tetrahedral
(c) square planar, tetrahedral and trigonal bipyramidal
(d) tetrahedral, square planar and square pyramidal

**13.** Mixture *X* with 0.02 mole of $[Co(NH_3)_5SO_4]Br$ and 0.02 mole of $[Co(NH_3)_3Br]SO_4$ was prepared in 2L of solution. *X* reacts with two different compounds as follows:

1L of mixture '*X*' + excess $AgNO_3 \longrightarrow$ '*Y*'

1L of mixture '*X*' + excess $BaCl_2 \longrightarrow$ '*Z*'

The number of moles of '*Y*' and '*Z*' are respectively.

(a) 0.01, 0.01 (b) 0.02, 0.01
(c) 0.01, 0.02 (d) 0.02, 0.02

**14.** Two oxides of a metal '*M*' contains 27.6% and 30% of oxygen, respectively. If the formula of the first oxide is $M_3O_4$, then that of the second is

(a) $M_2O_3$ (b) $M_2O$
(c) $MO_2$ (d) $M_2O_4$

**15.** Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenyl amine as an indicator. The number of moles of Mohr's salt required per mole for dichromate is

(a) 3 (b) 4 (c) 5 (d) 6

**16.** The solubility of metal hydrides depends on their nature, lattice enthalpy and hydration enthalpy of the individual ions. Among the fluorides of alkali metals, the lowest solubility of LiF in water is due to

(a) ionic nature of lithium fluoride
(b) high lattice energy
(c) high hydration enthalpy for lithium ion
(d) low ionisation enthalpy of lithium atom

**17.** In an experiment, the same amount of Zn is treated separately with excess of sulphuric acid and excess of sodium hydroxide. The ratio of volumes of hydrogen evolved is

(a) 1 : 1 (b) 1 : 2 (c) 2 : 1 (d) 9 : 4

**18.** In the analysis of 0.500 g sample of feldspar, a mixture of the chlorides of sodium and potassium is obtained, which weighs 0.1180 g. Subsequent treatment of the mixed chlorides with $AgNO_3$, gives 0.2451 g of AgCl. What is the percentage of a sodium oxide and potassium oxide in feldspar?

(a) 10.62% $Na_2O$, 3.58% $K_2O$ (b) 3.58% $Na_2O$, 10.62% $K_2O$
(c) 10.62% $Na_2O$, 35.8% $K_2O$ (d) 35.8% $Na_2O$, 10.62% $K_2O$

**19.** A 2 g of sample containing sodium carbonate and sodium bicarbonate was heated to a temperature at which all the sodium bicarbonate in the sample was converted to $Na_2CO_3$, $CO_2$ and $H_2O$. The final weight of the sample after heating becomes 1.752 g. The percentage of $Na_2CO_3$ in the sample is

(a) 76% (b) 66% (c) 72% (d) 54%

**20.** Which of the following statements is correct?

(a) Increase in electronegativity down the group is accompanied by a decrease in non-metallic properties
(b) Electronegativity is inversely proportional to the metallic properties of elements
(c) Non-metals have less tendency to gain electron
(d) All of the above

**21.** Which of the following depicts the correct order of increasing size of given species?

(a) $S^{2-} < Cl^- < Ar < K^+ < Ca^{2+}$
(b) $Ca^{2+} < K^+ < Ar < Cl^- < S^{2-}$
(c) $Ar < Cl^- < S^{2-} < Ca^{2+} < K^+$
(d) $K^+ < Ca^{2+} < S^{2-} < Cl^- < Ar$

**22.** Consider the following statements about molecular orbital theory and identify the incorrect statement.

(a) The electrons in molecules are present in the various molecular orbitals as the electrons of atoms are present in the various atomic orbitals
(b) The atomic orbitals of comparable energies and proper symmetry combine to form molecular orbitals

(c) In a molecular orbital an electron is influenced by two or more nuclei, depending upon the number of atoms in the molecule

(d) An atomic orbital is polycentric while a molecular orbital is monocentric

**23.** In which of the following pairs of molecules/ions both the species are not likely to exist?

(a) $H_2^+, He_2^{2-}$ (b) $H_2^-, He_2^{2-}$ (c) $H_2^{2+}, He_2$ (d) $H_2, He_2^{2+}$

**24.** Vinegar is used in food preservations. The main ingredient of vinegar is acetic acid that gives it a pungent taste. A sample of vinegar has 5 per cent $V/V$ acetic acid. The density of acetic acid is 1.05g/mL. ($K_a = 1.75 \times 10^{-6}$)

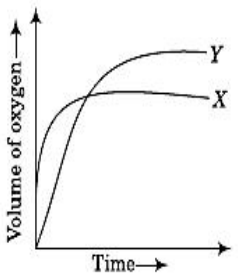
The molarity and pH of the above acetic acid solution is

(a) 0.875 M, 2.407 (b) 0.724 M, 3.100

(c) 0.875 M, 3.100 (d) 0.724 M, 2.407

**25.** Curve $X$ on the graph given below, shows the volume of oxygen formed during the catalytic decomposition of a 1.0 mol/dm$^3$ solution of hydrogen peroxide.

$$2H_2O_2(aq) \longrightarrow O_2(g) + 2H_2O(l)$$




Which change would produce the curve $Y$?

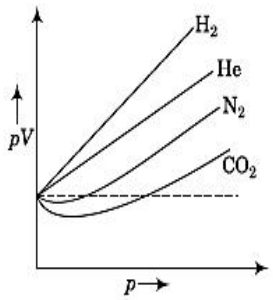
(a) Adding water

(b) Adding some 0.1 mol dm$^{-3}$ hydrogen peroxide solution

(c) Using a different catalyst

(d) Lowering the temperature

**26.** Consider the following graph of $pV$ *versus* $p$




Find out for which gases compressibility factor (Z) is greater than 1

(a) $H_2$ and $N_2$ (b) $N_2$, $CO_2$ and He

(c) He and $CO_2$ (d) $H_2$ and He

**27.** Match the items in Column I with its main significance listed in Column II.

| Column I | Column II |
|---|---|
| A. Photon | p. Value is 4 for $N$-shell |
| B. Electron | q. Probability density |
| C. $\psi^2$ | r. Always positive value |
| D. Principal quantum number ($n$) | s. Exhibits both momentum and wavelength |

**Codes**

| | A | B | C | D |
|---|---|---|---|---|
| (a) | p | q | r | s |
| (b) | s | s | q,r | p,r |
| (c) | p,q | r | s | q,s |
| (d) | p,q | q | q,r | p,s |

**28.** Experimentally it was found that a metal oxide has formula $M_{0.98}O$. Metal $M$, present as $M^{2+}$ and $M^{3+}$ in its oxide. Fraction of metal which exists as $M^{3+}$ would be

(a) 4.08% (b) 6.05%

(c) 5.08% (d) 7.01%

**29.** For complete combustion of ethanol,

$$C_2H_5OH(l) + 3O_2(g) \longrightarrow 2CO_2(g) + 3H_2O(l)$$

The amount of heat produced as measured in bomb calorimeter is 1364.47 kJ/mol at 25°C. Assuming ideality the enthalpy of combustion, $\Delta H$, for the reaction will be [$R$ = 8.314 kJ / mol]

(a) – 3810.21 kJ / mol

(b) – 3350.50 kJ / mol

(c) – 3858.67 kJ / mol

(d) – 3361.95 kJ / mol

**30.** The reaction of $CH_3CH=CH-C_6H_4-OH$ with HBr gives

(a) $CH_3CHBrCH_2-C_6H_4-OH$

(b) $CH_3CHBrCH_2-C_6H_4-Br$

(c) $CH_3CH_2CHBr-C_6H_4-OH$

(d) $CH_3CH_2CHBr-C_6H_4-Br$

# Answers with Explanation

**1.** **(a) Thinking process** *First calculate $\Delta G°$ with the help of following formula.*

$$\Delta G° = \Delta H° - T\Delta S°$$

*Then, calculate $K_{eq}$ with the help of following formula.*

$$\Delta G° = -RT \ln K_{eq}$$

$$\Delta G° = \Delta H° - T\Delta S°$$

$$= -29.8 - 298\,(-0.100)$$

$$= -29.8 + 29.8$$

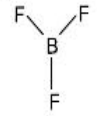
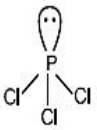
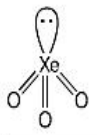
$$\Delta G° = 0 \quad \text{or} \quad 0 = -RT \ln K_{eq}$$

or $$\ln K_{eq} = 0 \quad \text{or} \quad K_{eq} = e^0 = 1$$

**2.** **(c) Strategy** *Generally, the molecules in which same number of atoms and lone pairs are attached to the central atom, possess same shape.*

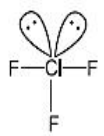
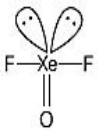
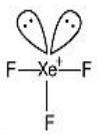
**For option (a)** Atoms attached to the central atom are different. So, we will check this option in the last if needed.

**For option (b)** Atoms attached to the central atom are same, so we will check for lone pairs.

| Molecule | Lone pair |
|---|---|
|  | Zero |
|  | One |
|  | One |

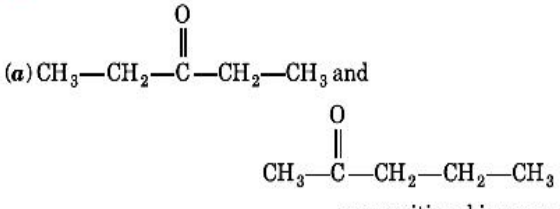
Hence, option (b) is incorrect.

**For option (c),** Atoms attached to the central atom are same. Again, we will check for lone pairs.

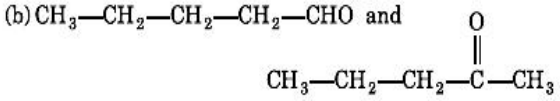
| Molecule | Lone pair | Shape |
|---|---|---|
|  | Two | T-shaped |
|  | Two | T-shaped |
|  | Two | T-shaped |

Hence, option (c) is correct.

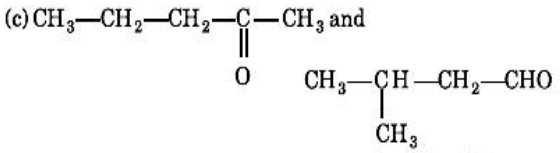
We don't need to check option (d) because of saving time purpose.

**3.** **(a)** 

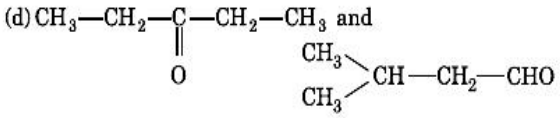
are positional isomers

**(b)** 

are functional isomers

**(c)** 

are functional isomers

**(d)** 

are functional isomers

**4.** **(a)** $A + 2B + 3C \longrightarrow AB_2C_3$

Given, 6.0 g of $A$, $6.0 \times 10^{23}$ atoms of $B$ and 0.036 mole of $C$ yields 4.8 g of compound $AB_2C_3$.

Atomic mass of $A$ = 60 u

Atomic mass of $C$ = 80 u

$$\text{Mole of } A = \frac{6}{60} = \frac{1}{10} = 0.1 \text{ mole}$$

$$\text{Mole of } B = \frac{6.0 \times 10^{23}}{6.023 \times 10^{23}} = 1 \text{ mole}$$

Mole of $C$ = 0.036 mole

According to reaction,

$$\underset{0.1\text{ mole}}{A} + \underset{0.2\text{ mole}}{2B} + \underset{0.3\text{ mol}}{3C} \rightleftharpoons \underset{0.1\text{ mole}}{AB_2C_3}$$

But we have only 0.036 mole of $C$

Thus, $C$ is limiting reagent

So, 0.036 mole of $C$ produces $\left(\frac{0.036}{3}\right)$ mole of $AB_2C_3$

$$\text{So, mole of } AB_2C_3 = \frac{\text{Mass}}{\text{Molecular mass}}$$

$$0.012 = \frac{4.8}{\text{Molecular mass of } AB_2C_3}$$

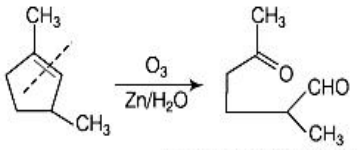
So, molecular mass of $AB_2C_3$ = 400 g mol$^{-1}$

Atomic mass of $A$ + 2 × atomic mass of $B$ + 3 × atomic mass of $C$ = 400

$$60 + 2B + 3 \times 80 = 400$$

So, atomic mass of $B$ = 50 u

**5.** (*b*)




5-keto-2-methylhexanal

**6.** (*a*) Electrolysis of aqueous $Na_2SO_4$, gives $H_2(g)$ at cathode and $O_2(g)$ at anode.

**7.** (*d*) Ammonical $CuCl_2$, forms red precipitate with terminal alkynes. It can be used to distinguish terminal alkynes from internal alkynes

$$CH_3—CH_2—C\equiv C—H + CuCl_2 \xrightarrow{NH_3(aq)} CH_3—CH_2—C\equiv \bar{C}\,Cu^+$$

Red ppt.

**8.** (*a*) Normality of oxalic acid solution

$$= \frac{\text{Mass of oxalic acid (in g)}}{\text{Equivalent mass of oxalic acid}} \times \frac{1000}{\text{Volume of solution (in L)}}$$

Equivalent mass of oxalic acid dihydrate $\left(\begin{matrix}COOH\\|\\COOH\end{matrix}\cdot 2H_2O\right)$

$$= \frac{126}{2} = 63$$

∴ Normality of oxalic acid solution

$$= \frac{6.3}{63} \times \frac{1000}{250}$$

$$= 0.4\ N$$

Now, we know that,

At neutralisation point,

$$\underset{\text{Oxalic acid}}{(N_1V_1)} = \underset{\text{hydroxide}}{(N_2V_2)}$$

∴ $0.4 \times 10 = 0.1 \times V_2$

or $V_2 = 40\ mL$

**9.** (*d*) When a weak acid (*HX*) is titrated against a strong base NaOH, basic salt (*NaX*) is present at the end point. This makes end point slightly basic with pH around 8. Hence, phenolphthalein, changes its colour in this pH range, would be the best choice of indicator to detect the end point.

**10.** (*a*) In $PbO_2$, Pb is in + 4 oxidation state and oxygen is in–2 oxidation state. In all other cases, peroxide ion ($O_2^-$) is present.

**11.** (*a*) The reagent should be strong Bronsted base.

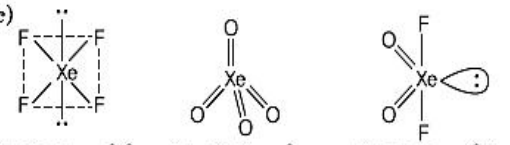
**Acidic order** $HNO_3 > RCOOH > HCN > H_2O > ROH$

**Basic order** $NO_3^- < RCOO^- < CN^- < \bar{O}H < RO^-$

Hence, decreasing order of basicities for β-elimination is

I > V > IV > III > II.

**12.** (*c*)




Hybridisation-$sp^3d^2$ Geometry-square planar

Hybridisation-$sp^3$ Geometry-tetrahedral

Hybridisation-$sp^3d$ Geometry-trigonal bipyramidal *or see-saw*

**13.** (*a*) ∵ In 2L solution, there are 0.02 mole of $Br^-$ ions and 0.02 mole of $SO_4^{2-}$ ions present.

∴ 1 L solution of '*X*' will contain 0.01 mole of $Br^-$ and 0.01 mole of $SO_4^{2-}$ ions.

Hence, '*Y*' = 0.01 mole AgBr, '*Z*' = 0.01 mole $BaSO_4$

**14.** (*a*) Let '*x*' be the atomic mass of Metal '*M*'

In the oxide $M_3O_4$,

the mass of '*M*' = 72.4 and that of 'O' = 27.6

$$\therefore \quad M_{\frac{72.4}{x}}O_{\frac{27.6}{16}} = M_3O_4;\ \frac{72.4}{x} : \frac{27.6}{16} = 3 : 4$$

$$\therefore \quad x = 56$$

For second oxide, the mass of '*M*' = 70 and that of 'O' = 30

$$\therefore \quad M_{\frac{70}{56}}O_{\frac{30}{16}} = M_{1.25}O_{1.875} = M_1O_{1.5} \text{ 'or' } M_2O_3$$

**15.** (*d*) The redox reaction between potassium dichromate and Mohr's salt is given as

$$6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \longrightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$$

**16.** (*b*) Due to small sizes of $Li^+$ and $F^-$ ions, lattice enthalpy becomes much higher than hydration enthalpy. Hence, LiF is least soluble among the alkali metal fluorides.

**17.** (*a*) Reaction of Zn with excess of sulphuric acid is given as

$$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2\uparrow$$

Reaction of Zn with excess of sodium hydroxide is given as,

$$Zn + 2NaOH \longrightarrow Na_2ZnO_2 + H_2\uparrow$$

Hence, the ratio of volumes of $H_2$ evolved in both the cases is 1 : 1.

**18.** (*b*) Suppose amount of NaCl in the mixture = *x* g

∴ The amount of KCl in the mixture = (0.118 – *x*) g

$$\underset{58.5\ g}{NaCl} + AgNO_3 \longrightarrow AgCl + \underset{143.5\ g}{NaNO_3}$$

∵ 58.5 g of NaCl gives 143.5 g of AgCl

∴ *x* g of NaCl will give $\left(\frac{143.5 \times x}{58.5}\right)$ g AgCl

Similarly,

AgCl obtained from KCl = $\frac{143.5 \times (0.118 - x)}{74.5}$ g

But on treatment of mixed chlorides with $AgNO_3$ 0.2451 g of AgCl is formed.

$$\left(\frac{143.5 \times x}{58.5}\right)g + \left(\frac{143.5 \times (0.118 - x)}{74.5}\right)g = 0.2451\ g$$

∴ *x* = 0.0338 g (Amount of NaCl)

(0.118 – *x*) = 0.0842 g (Amount of KCl)

Now, $\underset{117\ g}{2NaCl} \longrightarrow \underset{62\ g}{Na_2O}$

0.0338 g $\qquad \frac{0.0338 \times 62}{117}\ g = 0.0179\ g$

$\therefore$ Per cent of $Na_2O = \left(\frac{0.0179 \times 100}{0.5}\right)\% = 3.58\%$

and $\underset{149\text{ g}}{2KCl} \longrightarrow \underset{94\text{ g}}{K_2O}$

$0.0842\text{ g} \qquad \frac{0.0842 \times 94}{149}\text{g} = 0.0531\text{g}$

$\therefore$ Per cent of $K_2O = \frac{0.0531 \times 100}{0.5} = 10.62\%$

**19.** (*b*) The chemical reaction occured after heating the sample can be written as

$$\underset{(2 \times 84)\text{ g}}{2\,NaHCO_3(s)} \longrightarrow \underset{=168\text{ g}}{Na_2CO_3(s)} + \underbrace{CO_2 + H_2O}_{=62\text{ g}}$$

Here, the weight loss by the sample is due to evolution of $CO_2$ and $H_2O$.

$\therefore$ Weight of $CO_2$ and $H_2O$ evolved

$= (2 - 1.752)\text{ g} = 0.248\text{ g}$ 62 g of $CO_2$ and $H_2O$ are produced by 168 g of $NaHCO_3$

$\therefore$ 0.248 g of $CO_2$ and $H_2O$ are produced by $\left(\frac{168}{62} \times 0.248\right)$ g of $NaHCO_3$.

$\therefore$ Weight of $NaHCO_3$ in the sample = 0.672 g

Weight of $Na_2CO_3 = (2 - 0.672)\text{ g} = 1.328\text{ g}$

$\therefore$ Per cent of $Na_2CO_3 = \left(\frac{1.328 \times 100}{2}\right)\% = 66.4\% \simeq 66\%$

**20.** (*b*) Decrease in electronegativity from top to the bottom in a group is accompained by a decrease in non-metallic properties. Non-metals have strong tendency to gain electrons. Also, electronegativity is related to the metallic properties of elements and is inversely proportional to the metallic properties of elements.

**21.** (*b*) In the given set the species with same number of shell and same number of electrons but different number of protons are present. Thus, greater the electron to proton ratio ($e/Z$), greater will be the size of isoelectronic species.

Hence, the increasing order of the size of given species is

$$Ca^{2+} < K^+ < Ar < Cl^- < S^{2-}$$

$$e/Z \text{ value}: \quad \frac{18}{20} < \frac{18}{19} < \frac{18}{18} < \frac{18}{17} < \frac{18}{16}$$

**22.** (*d*) An atomic orbital is monocentric while a molecular orbital is polycentric.

**23.** (*c*) **Key concept** *Species having zero or negative bond order does not exist.*

For $H_2^{2+}(1 + 1 - 2 = 0) = \sigma 1s^0$

Bond order = 0

For $He_2\ (2 + 2 = 4) = \sigma 1s^2, \sigma^* 1s^2$

$\Rightarrow$ Bond order $= \frac{2 - 2}{2} = 0$

$\therefore H_2^{2+}$ and $He_2$ both does not exist.

**24.** (*a*) We have sample of vinegar which has 5% $V/V$ acetic acid, i.e. if vinegar is 100 mL then 5mL acetic acid present in it.

Volume of $CH_3COOH = 5$ mL

Density = 1.05 g/mL

We know, $d = \frac{m}{V} = \frac{m}{5\text{ mL}}$

$1.05\text{ g/mL} \times 5\text{ mL} = m$

$\therefore$ Molarity $= \frac{m}{\text{Molecular weight}} \times \frac{1000}{V\text{ (mL) of solution}}$

$= \frac{1.05 \times 5}{60} \times \frac{1000}{100} = 0.875\text{ M}$

Molarity $= 0.875\text{ M} = C$

We know, $pH = -\frac{1}{2}\log K_a - \frac{1}{2}\log C$

$= -\frac{1}{2}\log (1.75 \times 10^{-5}) - \frac{1}{2}\log(0.875)$

$= -\frac{1}{2}(0.2430 - 5) - \frac{1}{2}(-0.0580)$

$= 2.3785 + 0.029 = 2.407$

**25.** (*b*) The change would produce the curve $Y$, when we add some more 0.1 mol $dm^{-3}$ hydrogen peroxide solution.

**26.** (*d*) The deviation of gases from ideal gas behaviour is represented in the form of compressibility factor,

$Z = \frac{pV}{nRT}$

For ideal gases $Z = 1$

For $H_2$ and He, $pV > nRT$ at all the pressures.

Hence, $Z > 1$.

**27.** (*b*) A. Photon shows dual nature, i.e. it shows particle nature as well as wave nature. Hence, it exhibits both momentum and wavelength.

B. Electron also shows dual nature. Thus, it also exhibit both momentum and wavelength.

C. $\psi^2$ represents probability density and always has positive values.

D. Principal quantum number $n = 4$ for $N$-shell

$K\ L\ M\ N$

$n = 1\ 2\ 3\ 4$

It always has positive values.

**28.** (*a*) Metal oxide = $M_{0.98}O$

If '$x$' ion of $M$ are in + 3 state, then

$3x + (0.98 - x) \times 2 = 2$

$x = 0.04$

So, the percentage of metal in + 3 state would be

$\frac{0.04}{0.98} \times 100 = 4.08\%$

**29.** (*c*) Given reaction is,

$$C_2H_5OH(l) + 3O_2(g) \longrightarrow 2\,CO_2(g) + 3\,H_2O(l)$$

$\Delta E = -1364.47$ kJ / mol

For the reaction the value of $\Delta n_g = -1$

$\therefore \quad \Delta H = \Delta E + \Delta n_g RT$

$= -1364.47 + (-1)(8.314)(300)$

$\Delta H = -3858.67$ kJ / mol

**30.** (*c*) Electrophilic addition on C=C is governed by stability of carbocation